Claims

1. A method for the selective oxidation of at least one carbohydrate, a carbohydrate mixture or a composition having a content thereof, where an aqueous solution of the carbohydrate, of the mixture or of the composition is reacted in the presence of a gold catalyst comprising nanodispersed gold particles on a metal oxide support, and of oxygen.

2. The method as claimed in claim 1, where an aldehyde group of the carbohydrate(s) is oxidized selectively to a carboxyl group.

3. The method as claimed in claim 1 or 2, where the metal oxide support of the gold catalyst is a TiO_2 support.

4. The method as claimed in claim 3, where the TiO_2-supported gold catalyst comprises about 0.1% to 5% gold, preferably about 0.5% to 1% gold.

5. The method as claimed in claim 1 or 2, wherein the metal oxide support of the gold catalyst is an Al_2O_3 support.

6. The method as claimed in claim 5, where the Al_2O_3-supported gold catalyst comprises about 0.1% to 5% gold, preferably about 0.5% to 1% gold.

7. The method as claimed in any of claims 1 to 6, where the oxidation is carried out at a pH of from 7 to 11.

8. The method as claimed in any of claims 1 to 7, where the oxidation is carried out at a temperature of from 20°C to 140°C, preferably 40°C to 90°C.

9. The method as claimed in any of claims 1 to 8, where

the oxidation is carried out under a pressure of from 1 bar to 25 bar.

10. The method as claimed in any of claims 1 to 9, where oxygen and/or air is bubbled through the aqueous solution of the carbohydrate, of the mixture or of the composition during the oxidation.

11. The method as claimed in any of claims 1 to 10, where the ratio between the amount of the carbohydrate(s) to be oxidized or of the mixture and the amount of the gold present on the metal oxide support is greater than 1000.

12. The method as claimed in any of claims 1 to 11, wherein the carbohydrate to be oxidized is an aldose having an aldehyde group on the C1 carbon atom.

13. The method as claimed in any of claims 1 to 11, wherein the carbohydrate to be oxidized is in the 2-ketose form which is initially converted into the oxidizable tautomeric aldose form.

14. The method as claimed in claim 12 or 13, where the carbohydrate to be oxidized is a monosaccharide, an oligosaccharide, a mixture thereof or a composition having a content thereof.

15. The method as claimed in any of claims 12 to 14, where the monosaccharide to be oxidized is glucose, galactose, mannose, xylose or ribose.

16. The method as claimed in claim 15, where gluconic acid is obtained as oxidation product in the oxidation of

glucose.

17. The method as claimed in claim 14, where the oligosaccharide to be oxidized is a disaccharide.

18. The method as claimed in claim 17, where the disaccharide is a disaccharide aldose such as maltose, lactose, cellobiose or isomaltose.

19. The method as claimed in claim 18, where maltobionic acid is obtained as oxidation product in the oxidation of maltose.

20. The method as claimed in claim 18, where lactobionic acid is obtained as oxidation product in the oxidation of lactose.

21. The method as claimed in claim 17, where the disaccharide is a disaccharide 2-ketose such as palatinose.

22. The method as claimed in claim 14, where the carbohydrate to be oxidized is maltodextrin.

23. The method as claimed in claim 14, where the carbohydrate to be oxidized is a starch syrup.

24. A method for the selective oxidation of at least one oligosaccharide, a mixture thereof or a composition having a content thereof, where an aqueous solution of the oligosaccharide, of the mixture or of the composition is reacted in the presence of a gold catalyst comprising nanodispersed gold particles on a support, and of oxygen.

25. The method as claimed in claim 24, where an aldehyde group of the carbohydrate(s) is oxidized selectively to a

carboxyl group.

26. The method as claimed in claim 24 or 25, where the support of the gold catalyst employed is a TiO_2 support.

27. The method as claimed in claim 26, where the TiO_2-supported gold catalyst comprises about 0.1% to 5% gold, preferably about 0.5% to 1% gold.

28. The method as claimed in claim 24 or 25, where the support of the gold catalyst employed is an Al_2O_3 support.

29. The method as claimed in claim 28, where the Al_2O_3-supported gold catalyst comprises about 0.1% to 5% gold, preferably about 0.5% to 1% gold.

30. The method as claimed in claim 24 or 25, where the support of the gold catalyst employed is a carbon support.

31. The method as claimed in claim 30, where the carbon-supported gold catalyst comprises about 0.1% to 5% gold, preferably about 0.5% to 1% gold.

32. The method as claimed in any of claims 24 to 31, where the oxidation is carried out at a pH of from 7 to 11.

33. The method as claimed in any of claims 24 to 32, where the oxidation is carried out at a temperature of from 20°C to 140°C, preferably 40°C to 90°C.

34. The method as claimed in any of claims 24 to 33, where the oxidation is carried out under a pressure of from 1 bar to 25 bar.

35. The method as claimed in any of claims 24 to 34, where oxygen and/or air is bubbled through the aqueous

solution of the oligosaccharide, of the mixture or of the composition during the oxidation.

36. The method as claimed in any of claims 24 to 35, where the ratio between the amount of the oligosaccharide(s) to be oxidized or of the mixture and the amount of the gold present on the support is greater than 1000.

37. The method as claimed in any of claims 24 to 36, where the oligosaccharide to be oxidized is an aldose having an aldehyde group on the C1 carbon atom.

38. The method as claimed in claim 37, where the oligosaccharide to be oxidized is a disaccharide aldose.

39. The method as claimed in claim 38, where the disaccharide aldose is maltose, lactose, cellobiose or isomaltose.

40. The method as claimed in claim 39, where maltobionic acid is obtained as oxidation product in the oxidation of maltose.

41. The method as claimed in claim 39, where lactobionic acid is obtained as oxidation product in the oxidation of lactose.

42. The method as claimed in any of claims 24 to 36, where the oligosaccharide to be oxidized is in the 2-ketose form which is converted into the oxidizable tautomeric aldose form before the oxidation.

43. The method as claimed in claim 42, where the oligosaccharide to be oxidized is a disaccharide 2-ketose.

44. The method as claimed in claim 43, where the disaccharide ketose is palatinose.

45. The method as claimed in any of claims 24 to 36, where the oligosaccharide mixture to be oxidized is maltodextrin.

46. The method as claimed in any of claims 24 to 36, where the composition to be oxidized is a starch syrup.

47. An oxidation product obtainable by selective oxidation of at least one carbohydrate, a carbohydrate mixture or a composition having a content thereof by use of a gold catalyst comprising nanodispersed gold particles on a metal oxide support according to any of methods 1 to 23 or by selective oxidation of at least one oligosaccharide, a mixture thereof or a composition having a content thereof by use of a gold catalyst comprising nanodispersed gold particles on a support, as claimed in any of claims 24 to 46.

48. The oxidation product as claimed in claim 47, where the oxidation product is gluconic acid obtainable by oxidation of glucose.

49. The oxidation product as claimed in claim 47, where the oxidation product is maltobionic acid obtainable by oxidation of maltose.

50. The oxidation product as claimed in claim 47, where the oxidation product is lactobionic acid obtainable by oxidation of lactose.

51. The oxidation product as claimed in claim 47,

obtainable by oxidation of maltodextrin.

52. The oxidation product as claimed in claim 47, obtainable by oxidation of a starch syrup.

53. The use of a gold catalyst comprising nanodispersed gold particles on a metal oxide support for the selective oxidation of at least one carbohydrate, a carbohydrate mixture or a composition having a content thereof.

54. The use as claimed in claim 53, where the metal oxide support of the gold catalyst is a TiO_2 support.

55. The use as claimed in claim 54, where the TiO_2-supported gold catalyst comprises about 0.1% to 5% gold, preferably about 0.5% to 1% gold.

56. The use as claimed in claim 53, where the metal oxide support of the gold catalyst is an Al_2O_3 support.

57. The use as claimed in claim 56, where the Al_2O_3-supported gold catalyst comprises about 0.1% to 5% gold, preferably about 0.5% to 1% gold.

58. The use as claimed in any of claims 53 to 57, where the carbohydrate to be oxidized is a monosaccharide, an oligosaccharide, a mixture thereof or a composition having a content thereof.

59. The use as claimed in claim 58, where the monosaccharide to be oxidized is glucose, galactose, mannose, xylose or ribose.

60. The use as claimed in claim 59, where gluconic acid is obtained as product of the oxidation of glucose.

61. The use as claimed in claim 59, where the oligosaccharide to be oxidized is a disaccharide aldose.

62. The use as claimed in claim 61, where the disaccharide aldose to be oxidized is maltose, lactose, cellobiose or isomaltose.

63. The use as claimed in claim 62, where maltobionic acid is obtained as product of the oxidation of maltose.

64. The use as claimed in claim 62, where lactobionic acid is obtained as product of the oxidation of lactose.

65. The use as claimed in claim 58, where the oligosaccharide to be oxidized is a disaccharide ketose.

66. The use as claimed in claim 65, where the disaccharide ketose to be oxidized is palatinose.

67. The use as claimed in claim 58, where the carbohydrate to be oxidized is maltodextrin.

68. The use as claimed in claim 58, where the carbohydrate to be oxidized is a starch syrup.

69. The use of a gold catalyst comprising nanodispersed gold particles on a carbon support for the selective oxidation of at least one oligosaccharide, an oligosaccharide mixture or a composition having a content thereof.

70. The use as claimed in claim 69, where the carbon-supported gold catalyst comprises about 0.1% to 5% gold, preferably about 0.5% to 1% gold.

71. The use as claimed in claim 69 or 70, where the oligosaccharide to be oxidized is an oligosaccharide aldose.

72. The use as claimed in claim 71, where the oligosaccharide aldose to be oxidized is maltose, lactose, cellobiose or isomaltose.

73. The use as claimed in claim 72, where maltobionic acid is obtained as product of the oxidation of maltose.

74. The use as claimed in claim 72, where lactobionic acid is obtained as product of the oxidation of lactose.

75. The use as claimed in claim 69 or 70, where the oligosaccharide to be oxidized is in the 2-ketose form which is initially converted into the tautomeric aldose form and then oxidized.

76. The use as claimed in claim 75, where the oligosaccharide 2-ketose to be oxidized is palatinose.

77. The use as claimed in claim 69 or 70, where the carbohydrate to be oxidized is maltodextrin.

78. The use as claimed in claim 69 or 70, where the carbohydrate to be oxidized is a starch syrup.